## Version With Markings to Show Changes Made

**In the Specification:**

Page 4, replace the paragraph beginning at line 24 with the following:

Accordingly, an object of the present invention is to reduce size, increase efficiency and decrease cogging torque of a permanent magnet type [dynamo] rotary electric machine.

Page 5, replace the paragraph beginning at line 1 with the following:

According to one aspect of the present invention for achieving the above object, in a [dynamo] rotary electric machine with a stator and a permanent magnet type rotor, on or near circumferential surface of the rotor facing the stator p • n pieces of permanent magnet blocks are disposed, herein p is number of poles of the rotor and n is an interger equal to or more than 2, and each of the permanent magnet blocks satisfies the following conditions (a) through (e);

Page 5, replace the paragraph beginning at line 21 with the following:

+ in ± is for the case of an inner rotor type [dynamo] rotary electric machine and - in ± is for an outer rotor type [dynamo] rotary electric machine.

Page 5, replace the paragraph beginning at line 26 with the following:

Fig. 1 is a cross sectional view of an inner rotor permanent magnet type [dynamo] <u>rotary</u> electric machine 10 to which the present invention is applied taken perpendicularly to the rotary shaft thereof;

Page 6, replace the paragraph beginning at line 9 with the following:

Fig. 5 is a graph showing a relationship between ratio m/p of salient pole number m of a stator and pole number p of a rotor in an 8 pole surface magnet type [dynamo] <u>rotary</u> electric machine and teeth maximum magnetic flux density;

Page 6, replace the paragraph beginning at line 14 with the following:

Fig. 6 is a graph showing a relationship between ratio m/p of salient pole number m of a stator and pole number p of a rotor in another 8 pole surface magnet type [dynamo] <u>rotary</u> electric machine and teeth maximum magnetic flux density;

Page 7, replace the paragraph beginning at line 10 with the following:

Fig. 11 is a graph showing cogging torque relative values of [dynamo] <u>rotary</u> electric machines having different segmented numbers per one pole;

Page 7, replace the paragraph beginning at line 15 with the following:

Fig. 13 is a cross sectional view of a rotor 2 covered by a thin metallic cylindrical tube 4 taken perpendicularly to the [rotary] rotating shaft thereof;

Page 7, replace the paragraph beginning at line 18 with the following:

Figs. 14A and 14B are views showing examples of cross sectional configurations of a magnet binding member 25 taken perpendicularly to the [rotary] rotating shaft thereof;

Page 7, replace the paragraph beginning at line 22 with the following:

Figs. 15A and 15B are views showing examples of cross sectional configurations of a rotor 2 taken perpendicularly to the [rotary] rotating shaft thereof;

Page 7, replace the paragraph beginning at line 25 with the following:

Figs. 16A and 16B are views showing examples of cross sectional configurations of a magnet binding member 25 taken perpendicularly to the [rotary] rotating shaft thereof;

Page 8, replace the paragraph beginning at line 2 with the following:

Figs. 17A and 17B are views showing examples of cross sectional configurations of rotors 2 taken perpendicularly to the [rotary] rotating shafts thereof;

Page 8, replace the paragraph beginning at line 5 with the following:

Figs. 18A and 18B are views showing examples of cross sectional configurations of other rotors 2 taken perpendicularly to the [rotary] rotating shafts thereof;

Page 8, replace the paragraph beginning at line 8 with the following:

Figs. 19A and 19B are views showing examples of cross sectional configurations of still other rotors 2 taken perpendicularly to the [rotary] rotating shafts thereof; and

Page 8, replace the paragraph beginning at line 12 with the following:

Fig. 20 is a cross sectional view of an outer rotor permanent magnet type [dynamo] rotary electric machine 10 to which the present invention is applied taken perpendicularly to the [rotary] rotating shaft thereof.

Page 8, replace the paragraph beginning at line 20 with the following:

Fig. 1 shows a cross sectional structure taken in perpendicular to the rotary axis of an inner rotor permanent magnet type [dynamo] rotary electric machine 10 representing a first embodiment of the present invention. The [dynamo] rotary electric machine 10 includes a stator 1 and a rotor 2.

Page 8, replace the paragraph beginning at line 26 with the following:

The stator 1 is provided with a number of 12 salient poles, in that number of 12 slots, and to which are applied concentrated type windings (not shown). Teeth 11 and a core back 12 in the stator 1 are respectively formed by laminating electromagnetic steel plates, and after applying the concentrated type windings into the teeth 11 and inserting the same into the core back 12, the stator 1 is completed. The rotor 2 is disposed inside the stator 1 so as to permit rotation around the rotary axis while being supported by bearings (not shown). The bearings are supported by end brackets (not shown), and

through fixing the end brackets and a housing (not shown) surrounding the stator 1 the [dynamo] <u>rotary</u> electric machine 10 is constituted.

Page 10, replace the paragraph beginning at line 24 with the following:

In the rotor 2 according to the present embodiment, one pole is constituted by three magnet blocks 21. The rotor 2 shown in Fig. 1 is an 8 pole surface magnet type rotor. The magnet blocks 21 are directly pasted on the rotor shaft 22. The mutual magnet blocks 21, and the respective magnet blocks 21 and the rotor shaft 22 are bonded by an epoxy series adhesive and are secured <u>to</u> each other. In order to increase magnetic flux density on the magnet surface, the thinner [is] the adhesive layer the better, on the other hand in order to ensure [an] <u>a</u> bonding strength, it is necessary to provide a correspondingly thick adhesive layer. Accordingly, it is necessary to provide an adhesive layer corresponding to a predetermined bonding strength which is required depending on, <u>for example,</u> [such as] configuration and size of the rotor, configuration and size of the magnet and the material thereof.

Page 11, replace the paragraph beginning at line 15 with the following:

As the magnet used for the magnet blocks 21 any of ferrite series bonded and sintered magnets, NdFeB series bonded and sintered magnets, Sm-Co series sintered magnet and SmFeN series bonded magnet can be used. However, since each of the magnet blocks 21 is magnetized in the direction parallel with the direction shown by the arrow 21a, it is preferable in view of such as magnet performance and magnetizing performance to use oriented magnets, in that a variety of sintered magnets and anisotropic

bonded magnets. In particular, since it is concerned that the segmented Halback magnets such as the present embodiment tend to be demagnetized due to counter magnetic field, magnets having a large coercive force are preferable, especially the NdFeB sintered magnets are most preferable. Further, it is not necessarily required that the adjacent magnet blocks are closely bonded <u>to</u> each other and a spacer can be inserted therebetween. The spacer can be either non-magnetic material or ferromagnetic material, however, a ferromagnetic material having a larger saturation magnetic flux density than the remnant magnetic field density of the magnets is preferable.

Page 15, replace the paragraph beginning at line 3 with the following:

Further, if after dividing a cylindrical shaped magnet into a plurality of portions along the axial direction through perpendicular planes thereto, the respective divided portions are offset by a proper skew angle, cogging torque of the [dynamo] <u>rotary</u> electric machine can be reduced.

Page 18, replace the paragraph beginning at line 2 with the following:

Therefore, stator teeth 11 which locate at portions showing high surface magnetic flux density of the rotor 2 are placed in a condition likely to be magnetically saturated. When the teeth 11 are magnetically saturated, cogging torque will be generated. In such instance, if the circumferential width of the teeth 11 is [broaden] <u>broadened</u> to lower the magnetic flux density, cogging torque can be suppressed. However, since the windings are provided in the stator slots and the torque is also determined by the current supplied to the windings, if it is designed in the above manner that the teeth are broadened

and the slots are narrowed, necessary windings can not be applied and a predetermined [dynamo] <u>rotary</u> electric machine characteristic can not be obtained.

Page 18, replace the paragraph beginning at line 26 with the following:

Under the condition of the inequation (2), the winding can be wound in a concentrated winding. In the concentrated winding the number of salient poles equals the number of coils and the winding work of the concentrated windings is simple and easy when comparing to a distributed winding. Further, by employing a divided core in which the teeth and the core back are divided, the divided core can be assembled after applying the concentrated winding on the teeth, the space factor of the winding can be increased and magnetic loading can be enhanced, thereby, the size of the [dynamo] <u>rotary</u> electric machine can be reduced. In such instance the value of m/p is determined to be more than 0.75 and less than 1.5. If such condition is not fulfilled, the width of the slot opening portion has to be broadened for the concentrated windings and further, because of too many number of slots, the total width of the slot opening portions over the entire circumference has to be broadened. In association therewith, the cogging torque will [increases] <u>increase</u>. Therefore, the value of m/p is further preferable in a range more than 0.75 and less than 1.5.

Page 19, replace the paragraph beginning at line 22 with the following:

Since in the [dynamo] <u>rotary</u> electric machine as shown in Fig. 1, m=12 and p=8, the condition expressed by inequation (2) is satisfied. The surface magnetic flux density distribution of the surface magnet type rotor satisfying the above condition further

approximates to a sinusoidal waveform, when compared with a rotor using the radially magnetized magnets made of the magnet material having the same characteristics, which will be explained later. Further, the fundamental wave component in the surface magnetic flux distribution of the present embodiment shows a larger value than that formed by the radial magnetization.

Page 21, replace the paragraph beginning at line 21 with the following:

Even when the value of t/r is less than 0.15, if the rotor is provided with the magnetization vector distribution according to the present invention, the surface magnetic flux density distribution shows a sinusoidal waveform, the advantage with regard to the [dynamo] <u>rotary</u> electric machine characteristics can be enjoyed. However, when the magnet thickness is in a range which satisfies the above condition (t/r is more than 0.15), the fundamental wave component in the surface magnetic flux density can be increased in comparison with that of the radial magnetization magnet, and the torque generation can be increased. Further, when the magnet thickness is thin, demagnetization tends to be caused due to the magnetic field formed by the armature. For the above reason, the ratio t/r of the permanent magnet thickness t with respect to the rotor diameter r nearest to the stator is preferable to be more than 0.15, and more preferably to be more than 0.2.

Page 22, replace the paragraph beginning at line 13 with the following:

Since the fundamental wave component in the surface magnetic flux density can be increased as the magnet thickness is increased, if the segmented number per one pole is more than 1, thereby, a large torque can be generated. If the segmented number is more

than 2, the above advantage is further enhanced, and the surface magnetic flux density distribution approximates to a sinusoidal waveform and the higher harmonic components therein move to high degree, which are desirable for a [dynamo] <u>rotary</u> electric machine. Further, if the segmented number is more than 4, reduction of cogging torque can be expected, which is further preferable. However, the cogging torque does not monotonously decrease depending on increase of the segmented number, but if a proper segmented number for a value of m/p is selected, the cogging torque can be reduced very small. Even in the rotor according to the present invention an application of a skew to the surface magnets is effective for reducing cogging torque. Such application can be easily carried out by a skew in which the magnet blocks are divided along the axial direction into a plurality of portions and the respective divided portions are offset by a predetermined angle.

Page 23, replace the paragraph beginning at line 10 with the following:

Subsequently, with regard to four kinds of [dynamo] <u>rotary</u> electric machines, in that 8 poles 6 slots, 8 poles 9 slots, 8 poles 12 slots and 10 poles 12 slots [dynamo] <u>rotary</u> electric machines, cogging torques were compared when varying the segmented number per one pole of the surface magnets on the rotor from 1 to 6. The respective cogging torques are shown in relative values when the cogging torque of one segmentation (non-segmentation) is assumed as 1. Herein the one segmentation is the parallel magnetization in radial direction. Fig. 11 shows the comparison result.

Page 23, replace the paragraph beginning at line 21 with the following:

As will be apparent from Fig. 11, the cogging torques can be lowered for the segmented number of more than 1 in comparison with that of one segmentation. Further, it was found out that if rotor pole number and stator salient pole number are properly combined, there is an optimum segmented number which further reduces the cogging torque. According to the present embodiment, with respect to the 8 poles 6 slots and 8 poles 12 slots [dynamo] rotary electric machines the cogging torques are reduced for the segmented number more than 3 in comparison with the segmented number [upto] up to more than 2, and among these the segmented number of 4 showed the minimum cogging torque. With respect to 8 poles 9 slots [dynamo] rotary electric machine, the cogging torques are extremely reduced for the segmented number of more than 4. With respect to 10 poles 12 slots [dynamo] rotary electric machine, the segmented number of 2 showed a small cogging torque in comparison with other combinations and the segmented number of 5 showed a comparatively large cogging torque. However, the segmented number of 4 showed an extremely small cogging torque.

Page 24, replace the paragraph beginning at line 24 with the following:

When there is a magnetization error in a magnet block, it is possible that the cogging torque increases. Therefore, with respect to the 10 poles 12 slots [dynamo] rotary electric machine the cogging torque was evaluated by varying the magnetization direction of one of magnet blocks of which magnetization direction is set in the radial direction among the magnet blocks segmented into 3 per one pole. The magnet blocks other than

the above one particular magnet block were magnetized in the same degree of accuracy as in the first embodiment. Herein, magnetization error (%) is defined as (absolute value of the difference between designed magnetization vector and measured magnetization vector) / (absolute value of the designed magnetization vector) x 100. The measurement of the magnetization vector was performed in the like manner as in the first embodiment by making use of the VSM. Fig. 12 shows the measurement result.

Page 26, replace the paragraph beginning at line 7 with the following:

Now, another embodiment of the rotor 2 which can be used in the [dynamo] <u>rotary</u> electric machine 10 is shown. When the rotor 2 rotates in high speed, since a large centrigugal force acts on the magnet blocks aligned on the surface of the rotor shaft, it is preferable to cover the outer circumference of the magnets constituted in cylindrical shape with a thin metallic cylindrical tube or to wind around the same with a reinforcing tape. Therefore, for the [dynamo] <u>rotary</u> electric machine according to the present invention it is preferable to use a rotor 2 as sown in Fig. 13.

Page 27, replace the paragraph beginning at line 7 with the following:

Now, other embodiments of a rotor 2 which can be used for the [dynamo] <u>rotary</u> electric machine 10 are shown. Figs. 14A through 19B show cross sectional views of the rotor 2 taken perpendicularly to the rotary axis direction. Magnet binding members 25 arranged around the rotor shaft 22 as shown in Figs. 14A and 14B are prepared for forming 8 pole rotor and are provided with grooves 25a for receiving and binding the magnet blocks. In an example as shown in Fig. 14A, 8 grooves 25a each can receive 3

magnet blocks are provided. In an example as shown in Fig. 14B, 24 grooves 25a each can receive one magnet block are provided. Figs. 15A and 15B show states in which the respective magnet blocks have been received by the magnet binding members 25.

Page 30, replace the paragraph beginning at line 16 with the following:

Further, in the above explanation, inner rotor type [dynamo] rotary electric machine and rotors used therefor have been explained. However, the present invention is also applicable to outer rotor type [dynamo] rotary electric machines. Fig. 20 shows a cross sectional view of an outer rotor type rotor 2 taken perpendicular to the rotary shaft. The rotor 2 is constituted by bonding the magnet blocks 21 via an adhesive along the inner side of a rotor ring 23. In case of the outer rotor type [dynamo] rotary electric machine, the equation (1) is modified as follows:

Page 31, replace the paragraph beginning at line 1 with the following:

According to the present invention, the efficiency of permanent magnet type [dynamo] rotary electric machine can be enhanced while reducing size and cogging torque thereof.

In the Claims:

Please amend claims 1-7 as follows:

1. (Amended) In a [dynamo] rotary electric machine with a stator and a permanent magnet type rotor, on or near circumferential surface of the rotor facing the stator $p \bullet n$ pieces of permanent magnet blocks are disposed, herein $p$ is number of poles of the rotor and $n$ is an integer equal to or more than 2, and each of the permanent magnet blocks satisfies the following conditions;

$$(\theta i)-(\theta i+1)=\pm(Ai \bullet p/2) \qquad \ldots (1)$$

wherein, when assuming that clockwise direction is plus, $Ai$ is an angle formed between radial center lines of ith permanent magnet block and (i+1) th permanent magnet block, $\theta i$ is an angle formed between magnetization direction of the ith permanent magnet block and the outward radial direction thereof, $\theta i + 1$ is an angle formed between magnetization direction of the (i+1) th permanent magnet block and the outward radial direction thereof, and + in ± is for the case of an inner rotor type [dynamo] rotary electric machine and - in ± is for an outer type [dynamo] rotary electric machine.

2. (Amended) A [dynamo] rotary electric machine of claim 1, wherein the stator includes $m$ pieces of salient poles disposed with an equal interval and satisfies the following condition;

$$m/p \leq 1.5 \qquad \ldots (2)$$

3. (Amended) A [dynamo] rotary electric machine of claim 1 or claim 2, wherein when assuming that the outer diameter of the rotor as r and the thickness of each permanent magnet as t, the [dynamo] rotary electric machine satisfies the following condition;

$t/r \geq 0.15$ … (3)

4. (Twice Amended) A [dynamo] rotary electric machine of any one of claims 1 or 2, wherein the rotor is provided with a binding portion for binding the permanent magnet blocks on or near the circumferential surface thereof.

5. (Amended) A [dynamo] rotary electric machine of claim 4, wherein the binding portion is a groove provided on the circumferential surface of the rotor.

6. (Amended) A [dynamo] rotary electric machine of claim 4, wherein the binding portion is an aperture provided near the circumferential surface of the rotor.

7. (Twice Amended) A [dynamo] rotary electric machine of any one of claims 1 or 2, wherein each permanent magnet block is a NdFeB sintered magnet.

**<u>In the Abstract of Disclosure:</u>**

Page 34, replace the paragraph beginning at line 3 with the following:

In a [dynamo] <u>rotary</u> electric machine provided with a stator and a permanent magnet type rotor 2, on or near circumferential surface of the rotor 2 facing the stator 1 p • n pieces of permanent magnet blocks 21 are disposed, herein p is number of poles of the rotor and n is an integer equal to or more than 2, and each of the permanent magnet blocks satisfies the following condition (1);

Page 34, replace the paragraph beginning at line 25 with the following:

$m/p \leq 1.5$ ... (2),

thereby, a permanent magnet type [dynamo] <u>rotary</u> electric machine with reduced size, increased efficiency and decreased cogging torque can be realized.